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ARS 861 (2012) (English): Fortified maize
flour -- Specification



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Fortified maize flour — Specification



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Foreword

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This African Standard was prepared by the ARSO Technical Harmonization Committee on Agriculture and Food Products (ARSO/THC 1).

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Introduction

Maize flour or maize meal can be considered in fortification programs because they are staple foods in many parts of the world. For example, in Zambia, over two-thirds of the daily energy intake comes from maize; in Central America, almost one-half of the daily energy intake comes from maize flour; and in a number of other countries between 10 and 30 percent of daily energy intake is from maize flour or maize meal.

The concentration of vitamins and minerals to be added must be calculated based on nutritional requirements and consumption patterns, after which losses during storage and cooking must also be considered. Venezuela, for example, fortifies maize flour with a vitamin-mineral premix containing vitamin A, thiamin, riboflavin, niacin, and iron. Also, certain producers in Zimbabwe and Namibia fortify maize meal with a vitamin-mineral premix containing vitamin A, thiamin, riboflavin, niacin, folate, pyridoxine and iron.

This African Standard seeks to establish a uniform regime for fortification which, if adopted, would make it possible to trade in fortified maize meal or maize flour across the borders of the countries in the continent.

Fortified maize flour — Specification

1 Scope

This African Standard specifies the requirements and methods of sampling and testing for fortified milled maize (corn) products namely: maize meal and maize flour from the grains of common maize (*Zea mays* L.) intended for human consumption.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ARS 53, *General principles of food hygiene — Code of practice*

ARS 56, *Prepackaged foods — Labelling*

ARS 461, *Maize grains — Specification*

ARS 466, *Milled maize products — Specification*

ARS 471, *Food grade salt — Specification*

CAC/GL 1, *General guidelines on claims*

CAC/GL 2, *Guidelines on nutrition labelling*

CAC/GL 21, *Principles for the establishment and application of microbiological criteria for foods*

CAC/GL 23, *Guidelines for use of nutrition and health claims*

CODEX Stan 192, *General standard for food additives*

CODEX STAN 193, *Codex general standard for contaminants and toxins in food and feed*

ISO 711, *Cereals and cereal products — Determination of moisture content (Basic reference method)*

ISO 712, *Cereals and cereal products — Determination of moisture content — Reference method*

ISO 2171, *Cereals, pulses and by-products — Determination of ash yield by incineration*

ISO 5498, *Agricultural food products — Determination crude fibre content — General method*

ISO 6579, *Microbiology of food and animal feeding stuffs — Horizontal method for the detection of *Salmonella* spp.*

ISO 6888-1, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coagulase-positive staphylococci (*Staphylococcus aureus* and other species) — Part 1: Technique using Baird-Parker agar medium*

ISO 6888-2, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coagulase-positive staphylococci (*Staphylococcus aureus* and other species) — Part 2: Technique using rabbit plasma fibrinogen agar medium*

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ISO 6888-3, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coagulase-positive staphylococci (Staphylococcus aureus and other species) — Part 3: Detection and MPN technique for low numbers*

ISO 7251, *Microbiology of food and animal feeding stuffs — Horizontal method for the detection and enumeration of presumptive Escherichia coli — Most probable number technique*

ISO 7305, *Milled cereal products — Determination of fat acidity*

ISO 7954, *Microbiology — General guidance for enumeration of yeasts and moulds — Colony count technique at 25 °C*

ISO 11085, *Cereals, cereals-based products and animal feeding stuffs — Determination of crude fat and total fat content by the Randall extraction method*

ISO 13690, *Cereals, pulses and milled products — Sampling of static batches*

ISO 16050, *Foodstuffs — Determination of aflatoxin B₁, and the total content of aflatoxins B₁, B₂, G₁ and G₂ in cereals, nuts and derived products — High-performance liquid chromatographic method*

ISO 20483, *Cereals and pulses — Determination of the nitrogen content and calculation of the crude protein content — Kjeldahl method*

ISO 21527-2, *Microbiology of food and animal feedstuffs — Horizontal method for the enumeration of yeasts and moulds — Part 2: Colony count technique in products with water activity less than or equal to 0.95*

3 Definitions

For the purposes of this standard the definitions in ARS 466 and the following definitions shall apply.

3.1

diluent

a suitable, inert, edible food-grade carrier for micronutrients

3.2

premix

a blend of fortificants and diluents formulated to provide specified and determinable amounts of micronutrients

3.3

fortified milled maize products

maize meal, maize flour or sifted maize meal to which micronutrients have been added in accordance with this standard

3.4

fortificant

a compound which contains the specified micronutrient intended to be added to a food vehicle

3.5

food fortification

the practice of deliberately adding essential micronutrients in a food to improve the nutritional quality of the food and to provide a public health benefit with minimal risk to health

4 Quality requirements

4.1 Raw materials

Fortified milled maize products shall be produced from shelled maize conforming to the requirements of ARS 461.

4.2 General quality requirements

Fortified milled maize products shall be:

- of natural colour conforming to the colour of maize from which it was prepared.
- practically free from foreign matter such as insects, fungi and dirt.
- free from fermented musty or other objectionable colours.
- free from rancidity and foreign odours.
- wholesome and fit for human consumption in all aspects.

4.3 Specific requirements

Fortified milled maize products shall conform to the requirements given in Table 1.

Table 1 — Specific requirements for fortified milled maize products

S/ No.	Characteristic	Type of product				Test method
		Sifted maize meal	Granulated maize meal	Whole maize meal	Maize flour	
i)	Crude fibre content, % by mass, max.	0.7	1.0	3.0	0.7	ISO 5498
ii)	Crude fat a moisture free basis, % by mass, max.	2.25	2.25	3.1		ISO 11085
iii)	Moisture content, % by mass, max.	13	13	13	13	ISO 711 or ISO 712
iv)	Total ash, % by mass, max.	1.0	1.	3.0	1.0	ISO 2171
v)	Acid insoluble ash, % by mass, max.	0.15	0.35	0.40	0.15	Annex A
vi)	Crude protein (N x 6.25) % by mass, min	7.0	7.0	8.0	7.0	ISO 20483
vii)	Fat acidity, mg KOH per 100g of product, on dry mass basis, max	50	50	50	50	ISO 7305

5 Fortification requirements

5.1 Levels of micronutrients

The fortified milled maize products shall conform to the requirements and the levels of micronutrients provided in Table 2.

Table 2 — Requirements for micronutrients in fortified milled maize products

SI No	Nutrient	Fortificant compound	Recommended factory level, mg/kg	Regulatory levels, mg/kg	
				Minimum	Maximum
(i)	Vitamin A	Vitamin A (Retinyl) palmitate	1±0.4	0.5	1.4
(ii)	Vitamin B ₁	Thiamin Mononitrate	6.5± 2.9	3.0	(9.4)*
(iii)	Vitamin B ₂	Riboflavin	4±1.8	2	(5.8) *
(iv)	Niacin	Niacinamide	30±13.4	14.9	(43.4) *
(v)	Vitamin B ₆	Pyridoxine	5±2.5	2	(7.5) *
(vi)	Folate	Folic acid	1.2±0.5	0.6	1.7
(vii)	Vitamin B ₁₂	Vitamin B12 0.1% WS	0.015±0.007	0.007	(0.022) *
(viii)	Zinc	Zinc oxide	49±16	33	65
(ix)	Total iron	Total iron	31±10	21	41
(x)	Added iron	NaFeEDTA	20±10	10	30
* The figures in brackets may not be necessary because the upper tolerable limit for these nutrients is very high					

5.2 Fortificants

Fortificants for use shall be stable compounds conforming to specifications in any of the following documents:

- British Pharmacopoeia (BP),
- Food Chemical Codex (FCC),
- Merck Index (MI),
- United States National Formulary (NF),
- European Pharmacopoeia (Ph Eur),
- United States Pharmacopoeia (USP);
- FAO/WHO Codex Alimentarius Commission (CAC),

5.3 Premix

The fortificants shall be mixed with diluents or carrier as appropriate to form a premix. Diluents or carriers shall conform to USP, BP, Ph. Eur, NF, MI, FAO/WHO, or FCC.

The premix shall be made in such a way that at a given rate of addition to the product, the product shall conform to the requirements in Table 2.

The premix may be formulated to conform to the provisions given in Table 3.

NOTE 1 This premix formulation is designed with minimum nutrient composition and does not take into consideration factory overages in the preparations of the premix.

Table 3 — Formulation of premix for addition of micronutrients to milled maize products

Micronutrient	Fortificant compound	Amount of micronutrient to be added to food, mg/kg	Amount of fortificant to be added to food, mg/kg	Amount of fortificant in premix, g/kg	Amount of nutrient in premix, g/kg
Vitamin A	Retinyl Palmitate- 250,000 IU/g (dry)	1.0	13.3	26.7	2
Vitamin B ₁	Thiamin mononitrate	4.5	5.6	11.1	9
Vitamin B ₂	Riboflavin	3.0	3.0	6.0	6
Vitamin B ₃ (Niacin)	Niacinamide	25.0	25.3	50.5	50
Vitamin B ₆	Pyridoxine	5.0	6.1	12.2	10
Vitamin B ₉ (Folate)	Folic Acid	1.0	1.1	2.2	2
Vitamin B ₁₂	Vit. B-12 0.1% WS	0.015	15.0	30.0	0.03
Iron	NaFeEDTA	20	153.8	307.7	37
Zinc	Zinc oxide	40	50.0	100.0	80
	Filling material (at least 25%)		68.3	453.6	
		TOTAL	341.5	1000.0	

The premix shall be labelled with the addition rate (that is the amount of premix to be added to the milled maize product) in grams of premix per metric tonne of maize product and dilution factor.

Where the premix is made in accordance with Table 3, the addition rate shall be 500 g of premix per metric tonne of maize flour.

5.4 Stability of fortificants and premixes

The fortificants and premixes shall have storage stability such that no more than 20 % of its original activity will be lost when stored for 21 days at 45 °C in a well closed container at a level of 2.5g per kg in milled maize product having moisture content in the range of 13.5 % to 14.5 %.

The supplier of the premix shall provide the stability data for the fortificant and premixes.

6 Food additives

The product shall contain only permitted additives complying with CODEX STAN 192.

7 Hygiene

7.1 Fortified milled maize products shall be produced, prepared and handled in accordance with the provisions of appropriate sections of ARS 53.

7.2 The product shall be free from pathogenic micro-organism and shall comply with microbiological limits in Table 4.

Table 4 — Microbiological limits for milled maize products

Sl. No.	Micro-organism	Maximum limit	Methods of test
(i)	Total aerobic count, cfu, per g, max.	10^5	ISO 4833
(ii)	<i>Escherichia coli</i> , MPN, per g	< 3	ISO 7521
(iii)	<i>Salmonella</i> per 25 g	Not detected	ISO 6579
(iv)	Yeast and Moulds, cfu/g, max.	10^4	ISO 7954
(v)	<i>Staphylococcus aureus</i> , cfu, per g, max.	10	ISO 6888-1, ISO 6888-2 or ISO 6888-3

8 Contaminants

8.1 Heavy metals

Fortified milled maize products shall conform to those maximum limits for heavy metals established by the CODEX STAN 193.

8.2 Pesticide residues

Fortified milled maize products shall conform to those maximum residue limits established by the Codex Alimentarius Commission for this commodity.

8.3 Mycotoxins

Fortified milled maize products shall conform to those maximum mycotoxin limits established by the Codex Alimentarius Commission for this commodity. The milled maize products shall not exceed total aflatoxin of 10 µg/kg and 5 µg/kg for aflatoxin B₁ when tested in accordance with ISO 16050.

9 Packaging

9.1 Fortified milled maize products shall be packed in suitable packages which shall be clean, sound, free from insects, fungal infestation and the packing material shall be of food grade quality.

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9.2 Fortified milled maize products shall be packed in containers which will safeguard the hygienic, nutritional, technological and organoleptic qualities of the products.

9.3 The containers, including packaging material, shall be made of materials which are safe and suitable for their intended use. They shall not impart any toxic substance or undesirable odour or flavour to the product.

9.4 Each package shall be securely closed and sealed.

NOTE 1 Packaging materials may be required to meet different regulations in the different destination countries.

NOTE 2 The package fill should conform to the requirements of the legal metrology of the destination country.

10 Labelling

10.1 General labelling

In addition to the requirements in ARS 56, each package shall be legibly and indelibly marked with the following:

- i) The name of product as "Whole Maize Meal, Sifted Maize meal, Maize flour or Granulated Maize meal";
- ii) The word —fortified shall be declared before the name of the product
- iii) The name and address of the manufacturer/packer/importer;
- iv) Brand name/registered trade mark;
- v) Lot or batch number in code or in clear format;
- vi) Net weight in metric units;
- vii) The statement —Store in a Cool Dry Place and away from contaminants;
- viii) The statement "Food for Human Food";
- ix) Country of origin;
- x) Date of manufacture;
- xi) Best before date;
- xii) Instructions for disposal of used package.
- xiii) Each product unit may also be marked with the national food fortification Logo, where the industry qualifies to use the mark.

10.2 Nutrition labelling

The amount of micronutrients in the maize flour shall be declared on the label in accordance with CAC/GL 2.

10.3 Nutrition and health claims

Fortified milled maize products may have claims on the importance of the micronutrients in nutrition and health. Such claims when declared shall be consistent with CAC/GL 1 and CAC/GL 23.

11 Methods of sampling

Sampling shall be done in accordance with the ISO 13690 or ISO 24333.

12 Methods of testing

Testing for micronutrients may be conducted using any internationally recognized methods of test.

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Annex A (normative)

Determination of acid insoluble ash

A.1 Reagent

A.1.1 Dilute Hydrochloric Acid — 1:1, prepared from concentrated hydrochloric acid.

A.2 Procedure

A.2.1 Weigh accurately about 2 g of the dried material in a tared porcelain, silica or platinum dish. Ignite with a meker burner for about 1 hour. Complete the Ignition by keeping in a muffle furnace at 500 °C to 570 °C until grey ash results.

Cool and filter through whatman filter paper No. 42 or its equivalent. Wash the residue with hot water until the washings are free from chlorides as tested with silver nitrate solution and return the filter paper and residue to the dish. Keep it in an electric air oven maintained at 135 ± 2 °C for about 3 hrs. Ignite the dish again for about 30 minutes, cool and weigh. Repeat this process till the difference between two successive weighings is less than 1 mg. Note the lowest weight.

A.3 Calculation

A.3.1 Acid insoluble ash, per cent by weight

$$= \frac{100(M_2 - M)}{M_1 - M}$$

where,

M_2 = the lowest weight, in g, of the dish with the acid insoluble ash;

M = weight, in g, of the empty dish; and

M_1 = weight, in g, of the dish with the dried product taken for the test.

Bibliography

EAS 768:2012, *Fortified maize flour — Specification*

CODEX STAN 154:1985, *Standard for Whole Maize (Corn) Meal*

CODEX STAN 155:1985, *Standard for Degermed Maize (Corn) Meal and Maize (Corn) Grits*

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